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USSR DISCUSSION OF NON-SOVIET ARTICLES ON FERROMAGNETISM

/Comment: The following information was taken from the foreword and introductory remarks of issue No 2, 1953, of the Russian-language periodical Problemy Sovremennoy Fiziki (Problems of Modern Physics). This issue was devoted to complete and abridged translations and abstracts of non-Soviet articles and surveys on ferromagnetism that appeared in 18 American, English, German, French, Japanese, and Italian periodicals during 1950 - 1952. Only Soviet comments and critical comparisons of results are given below.

Announcements of past and future issues of Problemy Sovremennoy Fiziki, and lists of the non-Soviet periodicals and articles are appended.

Numbers in parentheses refer to appended bibliography./

Foreword

The present collection contains complete and abridged translations, and also abstracts of articles on certain problems of ferromagnetism and antiferromagnetism published in foreign periodical literature in 1950 and 1951. This issue is a continuation of issue No 5 (1952) of this series and encompasses the following problems: technical curve of magnetization (ferromagnetic domains, application of neutronography and magnetooptics for studying the structure of ferromagnetic domains, magnetization curves of ferromagnetic monocrystals and polycrystals, and properties of small particles and of thin films), nonmagnetic phenomena in ferromagnetics, and time phenomena in ferromagnetics and antiferromagnetics. Problems of technical ferromagnetic materials, high-coercive alloys, and magnetostriction of ferromagnetics could not be clarified in this collection because of lack of space. However, articles on these sections will be included in the next regular collection on ferromagnetism, along with recent materials on problems touched on in this and the preceding collections.

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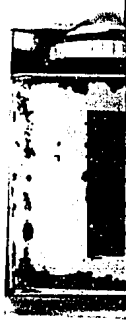

Of the works in Section I of the present collection, we should note investigations on the geometry of ferromagnetic regions (1), and also the survey of Bozorth (3) on powder figures on surfaces of ferromagnetic crystals (Akulov-Bitter figures). Of interest is the entire group of works in the second part of Section I on the application of neutronography to the study of ferromagnetic domains (15, 16, 17, 20, and 21), and also the first attempts to utilize for the same purpose the Kerr magnetooptic effect (18 and 19). Also to be noted are the works on the investigation of inverse magnetization processes (22 and 23) and especially investigations on properties of thin ferromagnetic films (28) and powders (29).

In Section II, the investigations of the Hall-Kikoin effect in ferromagnetics and measurements of electrical resistance during magnetization should be noted.

Section III contains articles on time phenomena in ferromagnetics. L. Neel's article (43), in which he develops a new theory of magnetic viscosity, is of greatest interest.

Section IV is devoted to antiferromagnetism and contains mostly only a bibliography of articles, since the Publishing House of Foreign Literature is preparing to issue in 1953 a special collection of articles on antiferromagnetism.

The introductions to all the sections of the collection give more detailed characteristics and scientific evaluation of the individual works translated in the collection. The introductions also indicate corresponding investigations of Soviet scientists, to which the foreign authors do not usually refer.

Section I. Technical Curve of Magnetization (pp 5-6)

This section contains abridged translations and abstracts of experimental and theoretical physical works on the technical magnetization curve of ferromagnetic monocrystals and polycrystals. This section is divided into four parts.

In the first part, (1 - 14) are given works on the theoretical and experimental investigation of ferromagnetic domains (domains of spontaneous magnetization). For the possibility of conscious utilization and direction of processes of technical magnetization, it is first necessary to have a clear representation of the magnetic structure of ferromagnetic domains. The fundamental work of L. D. Landau and Ye. M. Lifshits (see Phys Zs. 8, 153 /1935/) laid the foundations of the quantitative theory of ferromagnetic domains. All succeeding investigations in this field are a further development of this work. Particularly, this can be said also about B. Lilley's work (1), in which the author calculates the energy and thickness of the boundary layer between ferromagnetic domains in crystals of various systems. The article contains detailed computations and is of value to all who understand the theory of ferromagnetic domains. In the next work (2), the calculation of the energy of the boundary layer of ferromagnetic domains is made precise by way of calculation of a term, in the energy of magnetic anisotropy, which /term/ contains the second constant K_2 of anisotropy, and also the effects of deformation, which is experienced by this layer during its displacement in the magnetization process, the magnitude of the layer's energy.

The survey of R. Bozorth (3) is devoted to an exposition of the results of recent experiments on an investigation of Akulov-Bitter powder figures, which give a picture of the structure of ferromagnetic domains on the surfaces of ferromagnetic single crystals. These investigations give further confirmation of the theory of Landau and Lifshits on the structure of ferromagnetic domains. Devoted to this same problem are Yamamoto and Iwata's work (5) and also articles

7 - 14, given in the form of brief abstracts. C. Kittel's work (6) discusses the interesting problem of the possible formation of dipole domains in paramagnetic crystals at low temperatures. Finally, K. Stewart's work (4) investigates the magnetization process in a single crystal of ferrosilicon alloy in the form of a closed rectangular frame. The author reveals a number of new phenomena which permit one to make precise the existing representations concerning the process of shifting of boundary layers among ferromagnetic domains during magnetization of a ferromagnetic.

The second part (15 - 21) contains translations of very interesting works on the use of neutron rays and magnetooptic phenomena for determining the bulk and surface structure of ferromagnetic domains. /Three representative non-Soviet works are then briefly discussed./

In the third part (22 - 27) are translations and abstracts of works in which certain properties of curves of magnetization-and hysteresis loops are investigated in the case of monocrystalline and polycrystalline specimens of various ferromagnetic materials. /Then follows a brief discussion of three representative works./

The fourth part (28 - 32) contains translations and abstracts of theoretical and experimental investigations of the properties of thin films and fine powders of ferromagnetic materials. /Then follows a brief discussion of several representative works./

Section II. Nonmagnetic Phenomena in Ferromagnetics (p 97)

This section consists of translations and abstracts of articles devoted to the investigation of galvanomagnetics (33 - 37, 39) and magnetooptics (38) and electron-emission properties (40) and thermal (41, 42) properties of ferromagnetic materials.

It should be noted that Pugh and Rostoker's two works (33) and (34) on the study of the Hall effect in ferromagnetics completely ignore the works of Soviet authors (I. K. Kikoin, Sowjet Physik, 9, 1 /1936/; A. P. Komar and N. V. Volkonshteyn, Doklady Akademii Nauk SSSR, 60, 785 /1948/; V. Ye. Rudnitskiy, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 10, 474 /1940/; and A. G. Somoylovich and V. L. Kon'kov, ibid., 20, 783 /1950/), in which were established the fundamental laws governing the transverse galvanomagnetic phenomenon (Hall-Kikoin effect) in ferromagnetic bodies and in which were established particularly the dependence of Kikoin's constant on the magnitude of spontaneous magnetization. In J. Smit's work (35) on the study of the variation of electrical resistance of ferromagnetic metals and alloys at low temperatures, there are no references to the work of S. V. Vonsovskiy and K. P. Rodionov (Doklady Akademii Nauk SSSR, 75, 643 /1950/), in which was given the quantum-mechanical theory of this phenomena.

F. Roberts' work (38) described for the first time an investigation into the ferromagnetic-magnetooptic phenomenon of Faraday in the centimeter-wave band. This work reveals new possibilities of the experimental investigation of ferromagnetic materials.

Section III. Time Phenomena in Ferromagnetics (p 129)

This section contains translations and abstracts of articles devoted to problems of the behavior of ferromagnetic substances in aperiodic and periodic external magnetic fields.

The first half of the section (43 - 48) contains works on magnetic viscosity and magnetic postaction. Among these, the work of greatest interest is the theoretical investigation of L. Neel (43), in which an attempt is made to classify the various types of magnetic postaction (diffusive and diffusionless). The author introduces representations concerning the effective fields of postaction and concerning the stability of spontaneous magnetization, which permits one, within the framework of the semiphenomological theory, to obtain a sufficiently satisfactory description of the phenomena of magnetic postaction. It is necessary to note also the substantial deficiencies of this work: namely, by completely failing to mention the numerous investigations on magnetic postaction carried out by Soviet physicists (Arkad'yev, Vvedenskiy, Telesnin, etc.), and by not taking into account the results of these investigations, the author's analysis of this phenomenon remains far from complete. The experimental work of J. Barbier (44) in a familiar sense confirms certain conclusions from Neel's theory (43). The works of Fujimura (Huzimura) (45) and Maeda (46 and 47) are devoted to an investigation of the connection between magnetic postaction and irreversible processes of shift of boundary layers between domains of spontaneous magnetization.

Ch. Guilland's work (49) is an account of an investigation into the frequency dependence of magnetic permeability of ferrites, namely, ferromagnetic semiconductors. This article is of some interest in connection with the utilization of ferrites in high-frequency electrical engineering.

The last part of this section (50 - 58) is devoted to investigations into ferromagnetic resonance, a phenomenon which was first (in 1913) predicted theoretically and also discovered and investigated experimentally in the numerous works of V. K. Arkad'yev and his school.

Generally, the translations and abstracts presented in this collection are concerned with the further study of the phenomenon of ferromagnetic resonance in various ferromagnetic compounds.

Works No 59 - 66 are given only in the form of a bibliography, inasmuch as these works will soon appear in Russian in a special collection, now in preparation, of works on ferromagnetic resonance.

(It is necessary to note here that in the "ferromagnetism" collection of the "Problems of Modern Physics" series, No 5, 1951, pp 3 and 115, in commentaries of the editors, there was permitted a substantial inaccuracy in the evaluation of the work of V. K. Arkad'yev, well-known Soviet scientist, on ferromagnetic resonance. This phenomenon was not only theoretically predicted by Arkad'yev, as pointed out in the editors' commentaries, but also first discovered and investigated experimentally in the works of both Arkad'yev and his students. This fact is consistently ignored in works of foreign physicists, who, without basis ascribed the discovery of ferromagnetic resonance to Griffiths, the English physicist. The note of N. A. Smol'kov, "Ferromagnetic Resonance, a Russian Discovery." published in Elektrichestvo (No 5, 1952, pp 70 - 71), correctly pointed out the omission of the editors.)

Section IV. Antiferromagnetism (p 178)

This section contains investigations on antiferromagnetism (67 - 75). The phenomenon of antiferromagnetism, first predicted theoretically by L. D. Landau (1933), is presently attracting much attention. In fact, the property of antiferromagnetism permits one to penetrate more deeply into the structural details of crystalline lattices and to establish the character of the binding forces in these lattices. The study of antiferromagnetism assumes interest also in connection with the problem of ferritic magnetic materials, inasmuch as one is concerned in the ferrites, obviously, with an unusual union of ferromagnetic

and antiferromagnetic properties. The work of G. Foëx (67) is devoted to a clarification of the mechanism governing transition from the antiferromagnetic state to the paramagnetic state. Abstracts 68 - 75 concern studies of the antiferromagnetic properties of concrete substances.

Finally, there is a bibliography of 18 articles on antiferromagnetism that are proposed for inclusion in a special collection on antimagnetism being prepared for printing by the Publishing House of Foreign Literature in 1953.

Announcement of Publishing House

The following announcement has been made by the Publishing House of Foreign Literature, Administration of Scientific Information, concerning the series entitled "Problems of Modern Physics," a thematic symposia representing a collection of translations and surveys of foreign periodical literature.

These symposia or collections the announcement states, are intended for wide circles of Soviet specialists, namely, scientific workers and engineers, teachers of higher educational institutions, graduate students, and students interested in problems of modern physics and its technical applications. According to the announcement, these symposia have been issued since 1948.

The 1952 series (4th year of publication, 15 issues) consists of the following issues:

1. Acoustics
2. Accelerators of Charged Particles
3. Nuclear Reactions at Great Energies
4. Isomery of Atomic Nuclei (Isomerism)
5. Ferromagnetism
6. Cosmic Rays
7. Experimental Methods of Nuclear Physics
8. High-Energy Photons and Photonuclear Reactions
9. Luminescence
10. Application of Method of Marked Atoms to Chemistry, etc.
11. Electromagnetic Waves in Plasma
12. Propagation of Radio Waves in the Ionosphere
13. Neutron Physics I
14. Mass Spectrometers and Their Use in Chemical Studies
15. Neutron Physics II. Fission of Nuclei

The 1953 series (5th year of publication, 12 issues) contains the following:

1. Electron and Ion Emission
2. Ferromagnetism
3. Nuclear Shells (in printing)
4. Mesons and New Heavy Particles (in printing)

List of Non-Soviet Periodicals Used in Compiling Issue No 2 (1953)

1. Acta Crystallographica
2. Annalen der Physik
3. Comptes Rendus
4. Journal of Chemical Physics
5. Journal de physique et le radium
6. Journal of the Physical Society of Japan
7. Journal of Science of the Hiroshima University
8. Nature

9. Nuovo Cimento
10. Philosophical Magazine
11. Physica
12. Physical Review
13. Proceedings of the Physical Society
14. Proceedings of the Royal Society
15. Reports of British Electrical and Allied Industries Research Association
16. Reports on Progress in Physics
17. Science Reports of the Research Institutes, Tohoku University
18. Zeitschrift fur angewandte Physik

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